

Effect of mangrove rehabilitation on socio-cultural of pulau sembilan society, North Sumatera, Indonesia

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Abstract. Mangrove forests in North Sumatera, Indonesia existed in the east coast of Sumatera Island and commonly found in Serdang Bedagai, Deli Serdang, Batubara, Tanjung Balai, Asahan, Labuhanbatu until Langkat. The effect of rehabilitated mangrove on socio-cultural of Pulau Sembilan society, Langkat, North Sumatra, Indonesia was studied. The rehabilitation was carried on May 2015 using indirect planting of 2,100 *Rhizophora apiculata* seedlings. Two times of observations, May and August 2015 were made to monitor and evaluate 400 rehabilitated seedlings. Sixty of 600 households were surveyed using Slovin formula to obtain community perspective on the socio-cultural impact of mangrove rehabilitation. Results showed that the growth of *R. apiculata* seedlings were 73.3% during four months observations. The restoration affected 65, 58.3 and 35 % of economic, social, and cultural of Pulau Sembilan society, respectively. The perspective of community on the land-use change led to 66.7% was disagreed that mangroves to be converted, 60% respondents stated that mangrove condition was degraded even worse than previously existed. Therefore, to resolve the degraded mangrove, community perspective on rehabilitation was needed (85.5%) and actively involved (88.3%). The present results suggested that the high recommendation for a rehabilitation program for the degraded area was by integrating the stake holders (government, university, and non-governmental organization) and local communities count on the mangrove ecosystems.

1. Introduction

Mangrove forests distributed at the border between the aquatic and the terrestrial surroundings in the tropical and subtropical climates. Mangrove forests in North Sumatera, Indonesia covered 50,369.8 ha in the east coast of Sumatera Island and commonly thrived in Langkat, Deli Serdang, Batubara, Tanjung Balai, Asahan, Labuhanbatu until Serdang Bedagai [1]. In Langkat Regency mangrove has been lost more than 52% during between 1990-2015 observations. Mangrove forests in replacement to aquaculture and oil palm plantations are primary drivers of deforestation in Langkat [1].

Despite the fact that mangrove forests contributed largely to human communities that depend on mangroves for various products and ecosystem services [2], the study focused the effect of rehabilitation on socio-cultural communities adjacent mangroves are rarely reported. Such study could be noteworthy to evaluate the mangrove rehabilitation as well as conservation of mangroves. Our previous study showed that the local wisdom of community successfully to maintain the existence of



mangrove forest and to promote the rehabilitation efforts especially in barren land or abandoned aquaculture [3]. Furthermore protecting from mangrove loss would also reduce carbon dioxide emissions worth cost of less than \$10 per ton CO₂ [4]. The present study was therefore aimed to obtain community perspective on the socio-cultural impact of mangrove rehabilitation in Pulau Sembilan society, Langkat, North Sumatra, Indonesia.

2. Materials and Method

2.1. Study area

The study was carried out in Pulau Sembilan village, North Sumatra, Indonesia, covering an area about 24,000 km². The Pulau Sembilan village situated at 04° 08' 39.13" North latitudes and 98° 13' 55.38" East longitudes (Figure 1). Regionally, Pulau Sembilan located at Langkat Regency and district of Pangkalan Susu. Pulau Sembilan village bordered with Pulau Kampe in the North, the Aru bay in the West, Pangkalan Susu district in the South and Malacca Strait is in the East. The rehabilitation in Pulau Sembilan was carried on May 2015 using indirect planting of 2,100 *Rhizophora apiculata* seedlings. Two times of examinations, May and August 2015 were performed to monitor and evaluate 400 samplings of rehabilitated seedlings.

2.2. Analysis of community perspective on socio-cultural impact of mangrove rehabilitation

Analysis of view of Pulau Sembilan community knowledge on mangrove forest, Community's attention for the changing of mangrove conditions, and Perspective of community knowledge on mangrove rehabilitation were performed using questionnaires. Sixty head of household from a total of 600 households were surveyed using Slovin formula to obtain community perspective on the socio-cultural impact of mangrove rehabilitation.



Figure 1. Location of study area showing mangrove forest in Pulau Sembilan.

These respondents were collected to answer closed-ended questions [3]. Given a list of preset questions surveyed to respondents from which to select their response, including multiple answers and the meaning.

Table 1. Perspective of community knowledge on mangrove forest

No	Aspect	Age Class (Year)					Total	%
		21-30	31-40	41-50	51-60	61-70		
1	Knowing/be familiar							
	a. Yes	7	18	11	5	5	46	76.67
	b. No	1	5	4	1	3	14	23.33
2	Understanding the benefits							
	a. Yes	6	11	9	4	4	34	56.67
	b. No	2	12	6	2	4	26	43.33
3	Mangrove impact to income							
	a. Affected	6	12	11	3	7	39	65.00
	b. Unaffected	2	11	4	3	1	21	35.00
4	The effect to social life							
	a. Affected	4	13	10	3	5	35	58.33
	b. Unaffected	4	10	5	3	3	25	41.67
5	Impact on culture and society							
	a. Affected	2	8	5	2	4	21	35.00
	b. Unaffected	6	15	10	4	4	39	65.00

Table 2. Community's consideration for the changing of mangrove conditions

No	Aspect	Age Class (Year)					Total	%
		21-30	31-40	41-50	51-60	61-70		
1	Understanding the changing within five years							
	a. There are changes	7	17	14	5	7	50	88.33
	b. No changes	1	6	1	1	1	10	16.67
2	Disagreement for mangrove conversion							
	a. Yes	3	11	2	2	2	20	33.33
	b. No	5	12	13	4	6	40	66.67
3	Mangrove forest condition							
	a. Good	2	5	3	0	4	14	23.33
	b. Bad	4	13	11	5	3	10	60.00
	c. No idea	2	5	1	1	1	10	16.67
4	The changing mangrove forest within five years							
	a. Better	3	5	2	0	2	12	20.00
	b. Getting worse	3	12	11	5	5	36	60.00
	c. No idea	2	6	2	1	1	12	20.00
5	Response to degraded mangrove forest conditions							
	a. Very concerned	8	14	15	5	7	49	81.67
	b. Unconcerned	0	9	0	1	1	11	18.33

2.3. Data analysis

Obtained data were analyzed quantitatively to describe entire of community response to given questions. The data express community knowledge on mangrove forest, community's attention for the changing of mangrove conditions, and community knowledge on mangrove rehabilitation. Besides, data presented the effect of mangrove forests to socio and cultural society.

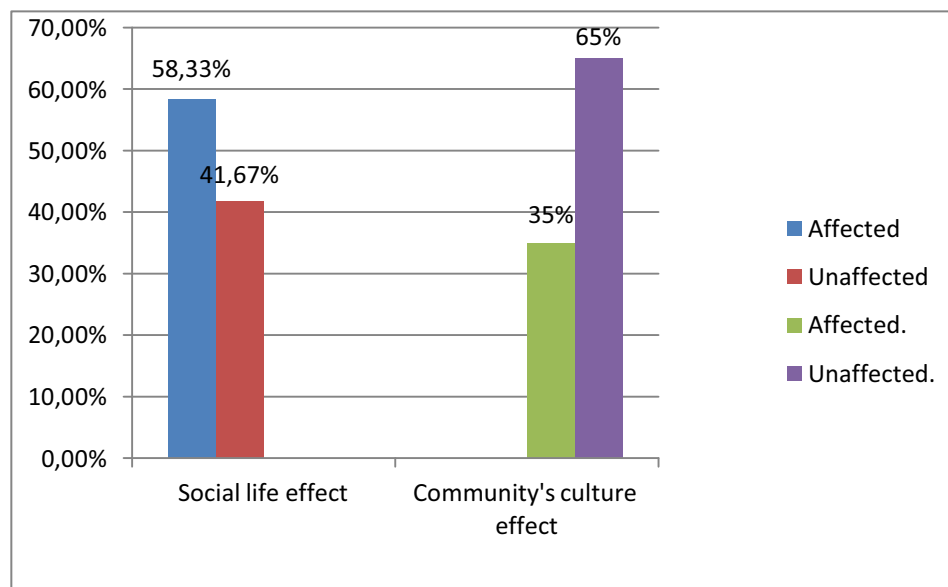


Figure 2. Effect of existences mangrove forest to socio and culture of community

Table 3. Perspective of community knowledge on mangrove rehabilitation

No	Aspect	Age class (Year)					Total	%
		21-30	31-40	41-50	51-60	61-70		
1	Understanding how to plant and maintain mangrove rehabilitation							
	a. Understand	4	8	10	2	6	29	48.33
	b. Not understand	4	15	5	4	3	31	51.67
2	Necessary/not for rehabilitation							
	a. Yes	8	18	13	4	7	50	83.33
	b. No	0	5	2	2	1	10	16.67
3	Agree/not to rehabilitate mangroves							
	a. Agree	8	18	14	4	7	51	85.50
	b. Not agree	0	5	1	2	1	9	15.00
4	People who should be involved in rehabilitation							
	a. Government only	0	2	2	1	1	6	10.00
	b. Community only	0	0	0	0	0	0	0
	c. Institutions only	0	0	0	1	0	1	1.67
	d. All parties (a, b and c)	8	21	13	4	7	53	88.33
5	Response to students/agency							
	a. Very supported	8	21	15	5	6	55	91.67
	b. Unsupported	0	2	0	2	1	5	8.33
6	Community participation in mangrove forest rehabilitation							
	a. Interested to get involved	7	20	15	4	7	53	88.33
	b. Uninvolved	1	3	0	2	1	7	11.67

3. Results and Discussion

There are two examinations on the growth of *R. apiculata* on May 18, 2015, and August 20, 2015. In the first observation, the average development from four plots was 74%. This growth rate became slightly lower (72.5%) in the second examination. Therefore the growth of *R. apiculata* seedlings was

73.5% during four months observations (data not shown). Our evaluation according to the regulation of Ministry of Forestry of Indonesian Government No. P.70/Menhut/II/2008 was an achievement. The limit for maintaining mangrove rehabilitation for the current year was above 70% growth rate.

Table 1 depicts the perspective of community knowledge on mangrove forest; more than 76.7 and 56.7 % of the local community knew mangrove and their benefits, respectively. This experience is lower than previously reported in Jaring Halus village [4]. Furthermore, the rehabilitation affected 65, 58.3, and 35 % of economic, social, and cultural of Pulau Sembilan society, respectively (Figure 1, Table 1). Community activities were ranging from searching for firewood, catching fish, and taking wood for building construction, are all benefits of mangrove forests that are not realized by the community [2]. Mangroves provide breeding, spawning, emerging, and nursery grounds for both coastal and offshore fish [5], suggested the ethnobiological function of mangrove to adjacent environment.

Tables 2-3 show the perspective of society on the land-use change led to 66.7% of respondents was disagreed that mangroves to be converted, 60% respondents stated that mangrove condition was degraded even worse than previously existed. Therefore, to resolve the degraded mangrove, community perspective on rehabilitation was needed (85.5%), actively involved (88.3%). The involvements of all stakeholders including local community mainly rely on mangroves for their lives are an active factor of mangrove restoration.

The rehabilitation efforts as part of mitigation action to reduce greenhouse gas from the conversion of mangroves as well as degraded area can protect the services and values of mangrove provide [1,6]. A part of significance restoration the Indonesian government established main mangrove species planted in Indonesia were *Bruguiera gymnorhiza*, *Rhizophora apiculata*, *R. stylosa*, and *R. mucronata* [1]. This study supported previous results on successful germination members of Rhizophoraceae [1,7]. In this context to Pulau Sembilan, the reforestation and rehabilitation can be implemented successfully by using the recommended species for degraded areas, and mangrove propagules or seeds are also available in the area. The development of mangrove restoration is necessary as a part of community-based mangrove management [8].

4. Conclusions

The high recommendation of a rehabilitation program for the degraded area was by integrating the stake holders (government, university, and non-governmental organization) and local communities dependent on the mangrove ecosystems. The present study suggested the important function of ethnobiology of mangrove to adjacent. The increasing awareness of local people in Pulau Sembilan supported the implementation of mangrove reforestation.

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